In re Application of: Ernest GRIMBERG
Serial No.: 10/567,438
Filed: February 7, 2006
Office Action Mailing Date: September 25, 2008

Examiner: Yara B. Green
Group Art Unit: 2884
Attorney Docket: 31322

REMARKS

Reconsideration of the above-identified application in view of the amendments above and the remarks following is respectfully requested.

Claims 62-83 are in this Application. Claims 62-64, 66, 67 and 71-73 have been rejected under 35 U.S.C. § 102. Claims 65, 68-70 and 74-83 have been rejected under 35 U.S.C. § 103. Claims 73 and 82-83 have been canceled herewith. Claims 62, 74-75 and 78-79 have been amended herewith.

Information Disclosure Statement

A supplemental Information Disclosure Statement which includes reference US Pat. No. 6,476,392 is being filed.

Amendments To The Claims

35 U.S.C. § 102 Rejections

The Examiner rejected claims 62-64, 66, 67 and 71-73 as being anticipated by US Pat. No. 7,030,378 by Allen et al (hereinafter *Allen*). It is submitted in response that independent claim 62 (and claims 63, 64, 66, 67 and 71-73 dependent thereon) are patentable, in the light of arguments set forth below.

The present application relates to the issue of accurately calculating external temperatures based on the output signal of a sensor array in an uncooled, unshielded IR detector. Due to the lack of a radiation shield around the detector, the detector output reflects not only the external IR radiation admitted by the optics but also includes a component reflecting the internal IR radiation emitted by the camera, which is generally several times greater than the impinging external IR radiation.

The problem addressed by the present application is how to eliminate the component due to internally-emitted radiation in the sensor output levels. Eliminating the component due to internally-emitted IR radiation enables the accurate calculation of the external temperatures from the output of an unshielded, uncooled IR detector.

The solution claimed herein is to perform periodic temperature measurements of one or more camera locations. These temperature measurements are made with the camera shutter closed, so that only the internally-emitted radiation arrives at the IR detector. The temperature measurements are used to derive a reference temperature which serves as a parameter in the external temperature calculations, in order to eliminate the effects of the internal IR radiation from the calculations. As stated on p. 18 lines 23-29 of the instant specification:

> During the same period of time that pictures are acquired for the NUC updating process, the reference temperature is measured and associated with the average video signal named AS_n. The video signal after NUC and BPR is used for the average calculation.
>
> Subsequently, when the shutter is in the non-obscuring position, the temperature at any point in the detector's field of view can be calculated from:
> $T_{i,j=}$ F ($p_{i,j}$ - AS_n , $E_{i,j}$, *temp_amb* , *etc)+ Reference_temperature*

It is seen from the above equation that the same reference temperature is used for each of the sensor outputs p_{ij}.

In the primary embodiment, a single reference temperature value serves as a parameter for calculating the temperature reflected by each of the IR sensors in the array. Since non-uniformities between the sensor outputs are eliminated during non-uniformity correction (NUC), all of the outputs, p_{ij}, have a uniform response to the incoming energy (i.e. photons) from the camera's field of view. Thus a single function may be used to calculate the external temperature for all of the IR sensors in the array. The reference temperature obtained by the calibrator serves as a parameter of that function,

which is applied uniformly to all the sensors in order to account for internally-generated radiation during the temperature calculations.

Applicant hereby amends claim 62 to state:

> 62. An infra-red imaging camera comprising:
> an uncooled and unshielded detector comprising an array of infra-red (IR) sensors arranged to detect infra red radiated energy,
> a non-uniformity corrector, associated with said detector, operable to perform non-uniformity correction on outputs of said array to provide uniform outputs having a uniform response to energy detected at said uncooled sensor, and
> a calibrator to carry out periodic calibration operations by taking at least one calibration temperature measurement over said camera and to derive from said at least one calibration temperature measurement a reference temperature indicative of radiated energy not from an external scene, said reference temperature being usable to correct energy detected at said uncooled detector to discount radiated energy not from an external scene, such that the reference temperature and the detector response to radiated energy impinging on said detector allow a temperature of objects in said camera's field of view to be calculated using a same signal to temperature function for each of said uniform outputs to obtain a temperature, wherein said reference temperature is a parameter of said function. (Emphasis added)

Corresponding amendments have been made to independent claims 74 and 79. Support for the unshielded detector including an array of IR sensors is found inter alia in p. 14, lines 11-13 of the instant specification. Support for non-uniformity correction is found inter alia in p. 18 lines 14-15 and in p. 19 lines 5-8. Support for using a same signal to temperature function for each of the uniform outputs is found inter alia in p. 18 line 17 to p. 19 line 14. Support for a reference temperature serving as a parameter in the signal to temperature function is found in p. 19 lines 1-2.

Claim 62 now explicitly states that the calibration temperature measurement is performed on the uniform outputs which are obtained after NUC. The reference temperature obtained during this measurement serves as a parameter to a single signal

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to temperature function which is applied to each of the uniform outputs. It is thus made clear that there is not a separate calibration factor for each IR sensor (i.e. pixel) of the array, but rather a single correction factor which is applied uniformly to all pixels in the array.

Applicant respectfully believes that *Allen* does not teach a reference temperature which is obtained after NUC correction, and which serves as a parameter of a single signal to temperature function which calculates the external temperature from each pixel readout. Since no NUC is performed before the readouts, the gain calibration parameter may be different for each pixel, and is therefore unsuitable to be applied to all of the pixels uniformly. *Allen* col. 23 lines 56-63 state:

> ...the gain and offset of a pixel may be used as calibration parameters to compensate for the gain and offset error of a pixel, such that the temperature of the pixel based on scene radiation may be determined. In particular, a gain of a pixel may be multiplied by a resistance valu of the pixel, measured at time x, to generate a temperature value of the pixel at time x that is corrected for gain error.

It is thus seen that *Allen*'s gain calibration parameter provides gain correction only for a specific pixel in the array.

In contrast, the present embodiments calculate the external temperature using the same signal to temperature function for each of the uniform sensor outputs which are obtained after NUC correction. The reference temperature serves as a parameter to this single signal to temperature function, uniformly to each of the sensor outputs.

The Applicant respectfully believes that Examiner's objections regarding lack of novelty are thereby overcome by the present amendments.

It is believed that the dependent claims are allowable as being dependent on an allowable main claim. The specific objections against the dependent claims are therefore not responded to individually.

35 U.S.C. §103 Rejections– Allen in view of Tsuchimoto

Claims 65, 68, 69, 74-80, 82 and 83 have been rejected under 35 U.S.C. §103(a) as being unpatentable over *Allen* in view of European Pat. Appl. EP 0837600 (hereinafter *Tsuchimoto*). It is submitted that claims 65, 68, 69, 74-80, 82 and 83 are patentable, in light of arguments set forth below.

The Examiner states that *Tsuchimoto* teaches measuring the radiation of the camera's closed shutter whose temperature is known by virtue of an attached thermistor, and that it would be obvious to a person skilled in the art to apply this feature to the sensors of *Allen*. However, Tsuchimoto does not disclose or suggest "using a same signal to temperature function for each of said uniform outputs to obtain a temperature, wherein said reference temperature is a parameter of said function". Thus neither *Allen* nor *Tsuchimoto*, alone or in combination, teach or suggest all the limitations of claims 65, 68, 69, 74-80, 82 and 83.

It is therefore submitted that claims 65, 68, 69, 74-80, 82 and 83 are both novel and inventive over the cited prior art.

35 U.S.C. §103 Rejections– Allen in view of Tsuchimoto and further in view of Everest

Claim 70 has been rejected under 35 U.S.C. §103(a) as being unpatentable over *Allen* in view of *Tsuchimoto* and further in view of US Pat. 4,907,895 by Everest (hereinafter *Everest*). It is submitted that claim 70 is patentable, in light of arguments set forth below.

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The Examiner states that *Everest* teaches coating at least part of the internal side of a shutter so that it is highly reflective, and that it would be obvious to a person skilled in the art to apply this to *Allen* as modified by *Tsuchimoto*. However, *Everest* does not disclose or suggest "using a same signal to temperature function for each of said uniform outputs to obtain a temperature, wherein said reference temperature is a parameter of said function". Thus neither *Allen* nor *Tsuchimoto* nor *Everest*, alone or in combination, teach or suggest all the limitations of claim 70.

It is therefore submitted that claim 70 is both novel and inventive over the cited prior art.

35 U.S.C. §103 Rejections– Allen in view of Tsuchimoto in view of Frey

Claim 81 has been rejected under 35 U.S.C. §103(a) as being unpatentable over *Allen* in view of *Tsuchimoto* in view of US Pat. 5,925,875 by Frey (hereinafter *Frey*). It is submitted that claim 81 is patentable, in light of arguments set forth below.

The Examiner states that *Frey* teaches using a high pass filter in conjunction with a focal plan array in order to remove unwanted temporal noise and fixed pattern noise components of an image signal at least part of the internal side of a shutter so that it is highly reflective, and that it would be obvious to a person skilled in the art to apply this feature to the method of *Allen* as modified by *Tsuchimoto*. However, *Frey* does not disclose or suggest "using a same signal to temperature function for each of said uniform outputs to obtain a temperature, wherein said reference temperature is a parameter of said function". Thus neither *Allen* nor *Tsuchimoto* nor *Frey*, alone or in combination, teach or suggest all the limitations of claim 81.

It is therefore submitted that claim 81 is both novel and inventive over the cited prior art.

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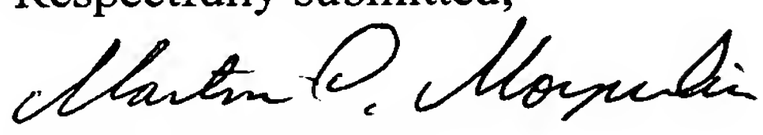
In view of the above amendments and remarks it is respectfully submitted that claims 62-72 and 74-81 are now in condition for allowance. A prompt notice of allowance is respectfully and earnestly solicited.

Respectfully submitted,



Martin D. Moynihan
Registration No. 40,338

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Enclosure:

- Petition for Extension (One Month)